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THESIS

THE ROLE OF SPECIFICATIONS AND STANDARDS
IN THE DEPARTMENT OF DEFENSE
ACQUISITION PROCESS

by

Mark L. Konetski

June 1986

Thesis Advisor:

Paul M. Carrick

Approved for public release; distribution is unlimited

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The Role of Specifications and Standards
in the Department of Defense
Acquisition Process

by

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Submitted in partial fulfillment of the
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June 1986

ABSTRACT

The purpose of this research was to investigate the role of the nongovernment standards setting bodies and the Department of Defense in the standards setting process, and; current DoD initiatives to streamline the acquisition process via more efficient selection and application of standards and specifications. Discussions and analyses were conducted in the areas of private standards setting organizations, motives for developing and using standards, various types of standards, and some problems encountered regarding the use or non-use of standards. Attention was focused on Department of Defense (DoD) policies and procedures for the development and adoption of standards and specifications and methods of interacting with nongovernment standards setting organizations. Specific examples were discussed regarding specification and standardization problems in the DoD followed by review of the DoD's Streamlining Initiative. Conclusions reached were: Methods used by the DoD to develop, write, and adopt standards and specifications were undecipherable from current literature; DoD specifications and standards are applied in a haphazard manner, and; The Streamlining Initiative is a successful step in solving some of the DoD's problems with overspecification.

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I. INTRODUCTION

A. GENERAL

This study will investigate the role of the nongovernment standards setting bodies and the Department of Defense in the standards setting process. Additionally, review will be made of current DoD initiatives to streamline the acquisition process via more efficient selection and application of standards and specifications.

One of the first tasks faced during the initial design phase of the Department of Defense acquisition process is the selection and application of various standards and specifications. In general, standards and specifications can be selected from two sources: from those developed and adopted by nongovernment standards setting organizations, commonly referred to as voluntary standards, and; from the Department of Defense Index of Specifications and Standards (DoDISS). The DoDISS contains mostly standards and specifications developed and written by the DoD (although it does contain some adopted voluntary standards).

Currently, as in the past, standards and specifications are called out as a matter of routine, usually without regard to their applicability to the current program or to the question of need. Guidance regarding the application of standards and specifications has been virtually non-existent and as a result the modus operandi was to do it as it has always been done, i.e., via blanket application of existing documents

with no attempt at tailoring to the specific program. When standards and specifications are applied prematurely, before learning what special problems, or opportunities, may arise during development; or rigidly, without tailoring to fit the particular program; or even inadvertently, through automatic reference to several subtiers of specifications, additional costs are incurred and contractors are prevented from implementing optimum design solutions.

B. OBJECTIVES OF THE STUDY

The objectives of this study were: (1) to investigate the procedures used to develop and adopt standards and specifications in the DoD, (2) to determine the policies, procedures, and implications of DoD adoption of private sector developed standards and specifications, and (3) to investigate the trade-offs made by a program manager regarding standards and specifications, and other equally important considerations, e.g. cost, schedule, and design suitability.

C. RESEARCH QUESTIONS

To achieve the objectives of this study the following question was posed: To what extent has the imposition of federal/military standards and specifications affected the cost and design of DoD acquisitions?

To assist in answering this basic question, and to bring the study into much clearer perspective, the following secondary research questions were addressed:

1. How are standards and specifications developed and adopted by the Department of Defense?
2. What interaction does the Department of Defense have with private standards setting organizations, e.g., ASTM, UL, SAE, etc.?
3. What procedures are available for private contractors to submit proposed standards and specifications to the Department of Defense for adoption?
4. If there is a method for private contractors to submit proposals, what method(s) does the Department of Defense employ for review and adoption (rejection) of the proposal?
5. In a given new acquisition what criteria does the program manager use in trading-off previously accepted standards when considering such things as cost, schedule, and design?

D. RESEARCH METHODOLOGY

The information and findings presented in this study were obtained from: (1) currently available literature, and (2) personal interviews with individuals knowledgeable in the standards and specifications arena. The literature search included the Naval Postgraduate School Library, the Defense Technical Information Center, the Defense Logistics Studies Information Exchange, literature obtained from non-government standards setting organizations, and current official publications, directives, and regulations.

E. SCOPE AND LIMITATIONS

This study is limited to the following: (1) investigation into the standards setting process within the Department of Defense, (2) how standards are employed in the acquisition process, (3) the role of the private standards setting organizations, and (4) standards and specifications as key elements in trade-off decisions.

F. ORGANIZATION OF THE STUDY

The organization of this study generally follows the arrangement of the research questions. Chapter II presents a detailed discussion of the role of the private standards setting organizations, motives for developing and using standards, types of standards, and problems encountered regarding the use or non-use of standards. Chapter III focuses on the Department of Defense and their policies and procedures for the development and adoption of standards and specifications. This chapter will also discuss DoD interaction with private standards setting organizations with regard to benefits and problems. Chapter IV will present, in some detail, specific examples where imposed military standards created difficulties and also where standards and specifications were necessarily traded-off to cost and other considerations. A discussion of the DoD's streamlining initiative will also be included. Chapter V presents a summary of the study, conclusions, and recommendations.

II. NON-GOVERNMENT STANDARDS

A. PRIVATE STANDARDS SETTING ORGANIZATIONS

1. General

At this point it is advantageous to describe the nongovernmental standards setting bodies (NGSBs) for the following reasons: (1) to be comfortable with the reasons why the NGSBs exist, (2) to provide a background of the atmosphere in which standards are created, and (3) to demonstrate the standards created, many of which are adopted by the Federal government, are in existence because business (large and small) wants them to be; businesses with which the Federal government, and specifically the DoD, conducts a great deal of business.

2. Standardization: A Definition

Before discussing the nongovernment standards setting bodies and the various types of standards it might be helpful to define, in broad terms, what a standard is. A standard is something taken for a basis of comparison or that which is accepted for current use through authority, custom, or general consent [Ref. 1:p. 4].

Given some thought, this definition has some strong implications. Consider taking something as a basis for comparison, a benchmark, if you will. In the personal computer industry, for example, there more than likely is not a single vendor that has not, at one time or another, used the IBM PC as a basis for comparison. The type of comparison itself is not important. The personal computer in question may be compared as being 100% compatible with the IBM PC, or it may be compared as being nothing like the IBM PC. The important point here is that the IBM PC is being used as a basis for comparison, which results in giving IBM a very strong market position. The last part of the definition, "is accepted for current use through authority, custom, or general consent," is the real key to making something a standard. Take for example the standard which specifies the size of the base of a light bulb. This standard has fallen very neatly into the definition by the way the industry has accepted it for use thereby making life less complicated for the rest of us. Consider, for example, the case where each light bulb manufacturer makes a different sized base and lamp manufacturers make completely different sized fittings. The task for the ultimate consumer, to decide on a particular manufacturer of bulbs and then to find a lamp, or other fixture, which fits the bulbs (or vice versa), would be enough to force the consumer to go back to using candles! This example is but one of many that could be considered, so the question of whether or not we need standardization will not be considered. It is obvious that we do, indeed, need standardization. How much standardization and in what areas are important considerations.

At this point, an important question must be answered. The question: Will competitive markets generate the correct amount of standards, or are they public goods? It can be argued that the various industries will generate a sufficient amount of standards, as long as it suits their needs. As discussed previously, American industry will not be in favor of standardizing just so they can be like everyone else. In many cases they are interested in building on their market share, their product differentiation, and their goodwill. Their main concern regarding standardization is generally not with concern for the effects of standardization on the economy or on society (although those aspects most certainly will be a consideration). Yet industrywide voluntary product standards can and do have a significant effect on the economy. A collective industrywide decision, for example, concerning what product characteristics are important and what quality levels constitute above or below standard can have a tremendous impact on competition and competitors, on industry structure, conduct, and performance. The simple selection of the appropriate measuring rod and test methods can be crucial, just as the decisions on how we measure "Gross National Product" or "Inflation," "Unemployment," and "Poverty" profoundly influence public policy choices.

The fact that many voluntary product standards become mandatory local, state, and federal standards underlines their importance. The National Electric Code, for example, despite minor modifications at the local level, provides 95 per cent of the electrical safety regulations in use in the United States. The Society of Automotive Engineers (SAE) technical standards are widely used by the

Federal Aviation Administration and the National Highway Safety Bureau as a basis for establishing standards. [Ref. 1: p. 10] Also, OMB Circular A-119 and DoD Directive 4120.3 establish a policy of federal government reliance on nongovernment standards in preference to military and federal documents whenever feasible and consistent with law and regulation. So, in answer to the question: Will competitive markets generate the correct amount of standards, or are they public goods?, the answer appears obvious. Markets will generate standards when it is in their best interest to do so (considering both industry and buyer well-being), or when powerful buyers, DoD for example, force them to do so. Standards are a public good. Once published they are there for all to use. Use of a standard by one interest will not diminish its usefulness or availability to other interests. Additionally, the use, or imposition of, some standards, as described above, have significant effects on the economy and on society. So, to dismiss the use or nonuse of standards, as something one should not be concerned with, is foolish. Standards are a public good and should be treated as such.

3. Associations and Societies

In contrast to most other countries, formal standards writing in the United States is largely a private affair. Nearly 400 distinct and private organizations administer the creation of U.S. voluntary standards. For example, of the 14,000 formal industrywide voluntary standards in existence in 1964, less than 3 per cent had been written under government auspices [Ref. 1:p. 81]. Since that time the number of

approved standards has continued to increase in the nongovernment sector. It is also important to note, however, that the number of military standards and specifications currently number in excess of 40,000. So, while it is important to remember that the nongovernment standards setting bodies (NGSBs) are a major contributor to the standards setting process, the DoD, just within itself, is also a major contributor (many DoD standards and specifications are de facto national and international standards [Ref. 7:p. 2-1]).

In the United States, standards are written primarily by engineering societies, such as the American Society of Mechanical Engineers (ASME) or the Institute of Electrical Electronics Engineers (IEEE), and by trade associations, such as the Business Equipment Manufacturers Association or the American Petroleum Institute. While a wide array of engineering societies and trade associations create standards, the bulk of the activity is performed by only a few organizations. As of 1964, for example, three institutions, the American Society for Testing and Materials (ASTM), the Society of Automotive Engineers (SAE), and the Aerospace Industries Association (AIA), wrote over one-half of all, of the then existing, voluntary industrywide standards. Another fifteen organizations prepared 20 per cent of the then existing standards. In 1985, the concentration is comparable, with the ASTM, ANSI, and the Aerospace Industries Association (AIA) leading the way. Although standards are not homogeneous in nature-some being much broader in scope than others-it is still clear that standards creation in the United States is a highly concentrated activity. [Ref. 1:p 81]

Typically, the trade association is a nonprofit organization of independent business competitors formed to promote the members' interests in a variety of ways. One important function of trade associations is to serve as a central clearinghouse for information, gathering and disseminating data on individual firm and industry sales, profits, accidents, etc. The association can also provide aid and advice to its members in a numbers of areas, such as accounting, marketing, and employee relationships. It may promote joint research, cooperative insurance, patent pooling, institutional advertising, as well as industrywide standards. It is the industry representative with government, unions, and the public. Overall, the association role is to improve the position of the industry in the economy, and in society.

Unlike the medical profession, engineers do not have a single major professional association which has acted to enhance the economic position of its members. Instead there has been a tendency toward the "Balkanization" of the occupation. There are presently over one hundred engineering societies, the twenty-three important national institutions containing some 650,000 members. Membership in the societies is individual, with membership stratified according to years of education and practice, and by accomplishments. The principal function of engineering societies is education. Their main role is to aid in the advancement and dissemination of engineering knowledge, primarily through journal publications and chapter meetings. These societies affect not only the engineer's continuing education, but also his formal education through membership in the Engineer's Council for Professional Development (ECPD). ECPD accreditation of schools is generally

accepted for purposes of the state licensing of engineers. Standards creation is often an important function of an engineering society. Among the societies there are quite different philosophies regarding this activity. The American Society of Construction Engineers (ASCE), for example, is not really a standards setting organization, though its members will sit with standards setting groups. The IEEE does create definitional and measurement standards, as well as standard test procedures, but it generally refuses to "put in the numbers." The IEEE believes that when a standard deals with economic and commercial matters, standard making should be left to a trade association such as the Nat'l Electrical Manufacturers Asso. (NEMA). [Ref. 1:p. 84]

As described above, private standards setting organizations are many and varied. Including organizations such as the Aerospace Industries Association (AIA), American Society for Testing and Materials (ASTM), Underwriters Laboratories (UL), Institute of Electrical and Electronics Engineers (IEEE), Society of Automotive Engineers (SAE), Electronic Industries Association (EIA), and many others. In summary form, the organizational purpose of these, and other standards setting organizations, are to (1) provide complete product standards, i.e., defining all procurement requirements in contrast to defining particular characteristics but not the specific finished product, (2) develop industry positions on matters related to management systems, manufacturing technology, quality assurance, and product support, (3) act as liaison with government agencies, (4) conduct research, analyses, and studies in areas applicable to their areas of expertise, (5) provide guidance, coordination, and policy

recommendations on international issues affecting commercial and military activities, (6) inform the membership on legislative affairs of direct interest to the industry and transmit to Congress the industry's views on such matters, (7) communicate to their membership, and to the public, the accomplishments, policies, positions, programs, and problems of their respective industries, and (8) represent their membership before various government regulatory agencies (as applicable).

As can be seen, these industry associations are not without purpose and very specific goals. As a result they have acquired a good deal of clout when considering issues related to the development and adoption of various industry standards. It would seem then, at first glance, that these associations, because they wield such a great deal of power, could easily dictate industry standards. This is true and will be discussed in more detail below. In devising any standard, consideration must be given to the fact that standards are best devised by organizations that represent both supplier and the customer or consumer, i.e., both sides of the market.

B. AMERICAN SOCIETY FOR TESTING AND MATERIALS

The American Society for Testing and Materials (ASTM) is one of the dominant standards writing bodies in America. By providing a broad forum for materials standardization, the ASTM has served an important coordination function, preventing much overlapping and duplication of activities by diverse groups in this general area. The ASTM contains

both individual and organizational membership. Unlike the SAE and ASME, who advocate the fiction that members serve entirely as individuals, the ASTM actually encourages the various conflicting interests, in standardization questions, to represent those interests. The ASTM operates under stricter procedures than do most other standardizing bodies. Committee membership, for example, is balanced between producers, buyers, and general interest groups, with a producer-oriented voting strength not to exceed 50 per cent. Technical committee chairmanship is restricted to a member in the nonproducing sector. These and other ASTM procedures make it *more* likely, in the words of a district court judge, "that results reached by them will be scientifically sound and will represent the general interest." [Ref. 1:p. 87]

C. AMERICAN NATIONAL STANDARDS INSTITUTE

The American National Standards Institute (ANSI), a national standardizing body. ANSI's predecessor organization, the American Engineering Standards Committee was created in 1918 by the ASTM and four engineering societies (mining, mechanical, civil, and electrical). The governmental departments of Commerce, War, and Navy were cofounders. Today the ANSI federation is composed of over 160 technical, professional, and trade associations, along with more than 1000 company representatives. ANSI's principal functions are to serve as a standards coordinator-to eliminate duplication, overlapping, unnecessary conflicts, and variations in standards-and to act as a

central clearinghouse for information on standards. ASTM spokesmen have sometimes argued that ANSI's desire to increase its role in standardization has led it to give blanket approval to standards whose creation procedures were far less than ideal. [Ref. 1:p. 88]

ANSI is dominated by larger firms [Ref. 12:pp. 19-23]. It is largely financed by the large-scale enterprise; most of the standards approved are written by organizations dominated by large-scale enterprises. Consumers have been given representation in ANSI via the creation of the Consumer Council. But the council's role is purely advisory, and is largely composed of (buying) industry personnel rather than spokesmen for the ultimate consumer. Even in those areas where final good standards are promulgated, the consumer has little real voice in determining standards. Consumers Union reports, for example, that, as with its experience with other standard writing bodies, its suggestions have consistently been voted down, overwhelmed by the "consensus" of industry [Ref. 1:pp. 88-89].

The consensus principle is crucial in the development of American standards. Explains ANSI: "A consensus does not necessarily mean unanimous acceptance. Votes are weighted rather than counted. A weighty objection of one important organization may outweigh all other affirmative votes. Or a number of negative votes of groups that are only distantly concerned with the subject matter may be discounted in the face of affirmative votes of parties that are vitally affected by the standard." [Ref. 1:p. 89] Observed James Ridgeway in the *New Republic*: "This means just about anything one might want it to mean, and in an

organization weighted toward the interests of business, it suggests that industry will get pretty much what it wants." [Ref. 1:p. 89]

From the above discussion of standards-making in the United States one can discern that there are varying philosophies and procedures. The two most powerful organizations, ASTM and ANSI, appear to be aiming at many of the same goals, but each organization also appears to go about their tasks in different ways. The ASTM, on the one hand, appears to making an attempt to structure the standards making activities in such a manner that the results will be as free from bias and undue influence as possible. The ANSI, on the other hand, appears from some indications to be bowing to the most powerful organizations in their standards-creating and approval activities. The standards then, as a result of ANSI policy, are what the big firms want and not necessarily what the industry, or the consumer, needs or wants. Or is this just not so? Even if the ANSI is dominated by the larger firms one must consider the "consensus principle" discussed earlier. The consensus principle states, in general, that the adoption of a standard is pretty much dependant on those businesses who are vitally affected by the standard. Based on that premise, the adoption of a standard will not be at the whim of the larger firms, but rather will be adopted because the "consensus" of the affected firms is that they wish to do so. The affected firms could easily consist of many small firms, a mix of large and small, or just the large firms. The matter of interest in the standard is important here, not whether you're large or small. There is still a real danger here. That is, the large firms could possibly use the process of standards creation to reduce and even eliminate competition

in their market place, or more commonly, use the process to fix prices. To counteract such a situation one must first learn, and be willing, to play the standards setting game (a political process); and secondly, realize that there are laws which govern such actions, e.g. antitrust legislation.

D. TYPES OF STANDARDS

1. General

Standard specifications serve a coordinating function, providing a focal point for purchase. The very fact that others purchase by standards can benefit the buyer qua buyer. For one thing, as standards become widely known, they should reduce the negotiation burden and decrease misunderstandings and disputes. Additionally, by ordering by standards the purchaser promotes price competition, since sellers are already producing such varieties. Conversely, it takes time, and risk, to quote on unusual specifications and fewer sellers are willing to compete for the order. Buying by standards also allows potential scale production economies, permits quick delivery, and insures future availability. All these factors effectively lower prices. On the other hand, standards may be more costly to write than specifications, since they require some consensus. Or they may be expensive to purchase from a standards writing organization. Since they are employed for different purposes, standard specifications can sometimes be too

general, or not perfectly suitable for a particular use. Additionally, technological changes can decrease the value of a standard. [Ref. 1:p. 55]

In general, there are two basic types of standards: (1) standards of uniformity, and (2) standards of quality. In the case of standards of uniformity "better" or "worse" is not the issue, but rather sameness or uniformity. Screw head standards for example. Standards for uniformity mean the deliberate reduction of variety, sometimes as to one type (as light bulb bases), sometimes to a number (as bed sizes). Deliberate reduction of product variety in an entire market is often identified with the term simplification. [Ref. 1:p. 8] Quality standards are a second major type of standard. Such standards are universally minimum rather than maximum standards. They divide products into categories of better (meeting the standard) and worse (not meeting the standard), superior and inferior. Quality standards are more likely to require enforcement than are standards of uniformity. [Ref. 1:p. 9]

2. Standards for Uniformity

Standards for uniformity include single product standards and interchangeability standards. Single product standards generally provide benefits in two areas: (1) improved information (particularly to buyers), and (2) lower costs, if purchases are focused on a few varieties, allowing economies of scale in production or distribution. [Ref. 1:p. 21] When sellers write standards for uniformity, there are two major problems: (1) the withholding of desired variety from the market place, and (2) the facilitation of illegal activity. The first

problem is perhaps more interesting theoretically, the latter appears more prevalent in the real world. The principal illegal activity in question is price-fixing, or at least this has always been the focus of antitrust activity involving standards [Ref. 1:p. 31]. Interchangeability standards for uniformity can permit economies of scale and improve information. They help limit variety, like single product standards, and thus allow longer production runs. They may reduce comparative shopping problems and can decrease other search costs. [Ref. 1:p. 37] The most important benefit of interchangeability standards is that they widen markets, thereby increasing alternative sources of supply. There are problems, however, with interchangeability standards. The greatest potential problems arise when sellers create the standards. Like all standards for uniformity, interchangeability standards might help suppliers to collectively withhold some desired variety from the market, or might facilitate illegal price-fixing schemes. The principal real world problems from such standards stem from the possibility that they might stifle innovation. [Ref. 1:pp. 38-39]

3. Quality Standards

The principal function for voluntary quality standards is to supply information [Ref. 1:p. 45]. As a commodity, information has some singular characteristics. First, information possesses many of the qualities of a public good. Knowledge is a non-rival good; enjoyment of it by one individual does not decrease the amount available to others. The producer of the information, in some sense, has a monopoly, and he

may seek to take advantage of this fact. An attempt to sell this information on the open market, however, may destroy this monopoly, if others can reproduce this information at little cost to themselves [Ref. 1:p. 47]. Take for example the software industry. Almost without exception the sale of a piece of software inevitably leads to its illegal use by anyone who can copy it. Albeit illegal, it is done without concern to laws regarding copyright infringement and the only way manufacturers can get around this is by continually updating their merchandise, thereby making the copied material somewhat obsolete. In other areas, those which the general public is not privy to, the value of information may not be known to the purchaser until after the information has been purchased. This means that, from a welfare point of view, the potential purchaser must often base his buying decision on less than optimal criteria. An example of this could be the company that purchases information relevant to what his closest competition is doing. The information received may, or may not be, useful in determining competitive strategy. But could he have confidently developed a strategy without it?

E. STANDARDS: SHOULD THEY BE USED?

To use a standard or not to use a standard is not the question facing each manufacturer. The question he must answer is : Which standards should be used? The choices are to chose a voluntary product standard, as "accepted" by the industry, or to develop his own standard, a unique company standard. The question must be answered based on the product

in question, competitive forces, who the ultimate consumer is, cost to develop a unique product, estimated acceptance of the unique product, and costs and benefits associated with the use or non-use of a standard. These, and other similar questions, must be asked and answered on a case by case basis.

F. STANDARDS: WHO WRITES THEM? WHO BENEFITS?

In the real world, some big companies may consider standardization from their own immediate narrow perspective, rather than being concerned with possible effects on small competitors. Presently, most voluntary standards-making organizations are dominated by large firms. This is generally the case for both the trade associations and engineering societies that write most of the formal standards in the United States. It is not difficult to understand why small business is underrepresented in the standardization process. The problem is that the absolute cost, in terms of time and money, of sending an employee representative to meetings is the same for the small as for the big firm. In addition, the benefits resulting from the fixed investment (to implement the new standard) accrue in larger quantities to the bigger firms.

The domination of business over the standardization process is further enhanced by the fact that many standards committees have little money for research. If needed research on a question is to be performed, business, particularly the large firms, must be convinced that it is in their own best interest to underwrite the cost. Via its

resources and research facilities, the large-scale enterprise may fundamentally determine the content of standards, as well as what standards get written. [Ref. 2:p. 67] While this may be true in some instances, the fact that a business is big is not the only determining factor regarding which standards get written. One must also consider other factors, such as, other interested parties and the "consensus principle" discussed earlier. However, it must also be recognized that standards writing is often a quasipolitical process, involving negotiation, bargaining, and compromise among a variety of interests [Ref. 1:p 78]. It is in this arena that the most powerful could have an edge, i.e., who are the best and most effective lobbyists?

There are exceptions, however, where the large concerns do not get what they want. For example, in the early years, the establishment of standards for alloy steel may be the most important single accomplishment of the SAE, yet it was here that the standards program met its bitterest opposition. Nowhere was the struggle against standards so intense as in the steel industry. The rule of the 1910 steel salesmen seems to have been "special brands, secret processes, and mysterious ingredients," combined with high prices and delays in delivery. Established steel manufacturers were understandably reluctant to relinquish brand advantages, and thus saw little direct benefit from providing detailed product information to buyers and helping them coordinate their purchases. The general attitude of the steel industry was perhaps typified by the sarcastic comment of a steel spring executive: "I say it is none of your business, Mr. Coffin (president of SAE), if I make my springs of pot metal. What is it to you,

if they carry a car and never break?" But SAE standards were written for steel, and generally supported by manufacturers, who were able to impose them on suppliers. [Ref. 1:p. 15-16] This is not to say that the standards generated will be detrimental to the smaller firms, they may not be as long as the smaller firms can come up with the needed capital in order to implement the new standard. But, what if the smaller firm cannot either afford to pay for the new standard or economically change his tooling or processing costs to accommodate the requirements of the new standard? It can be said that this is one of the areas where the large firms become different from the smaller firms, and rightly so. If everyone could make changes as the occasion dictated there would be little incentive to be better or different. This is one of the aspects of the free enterprise system that must be maintained if a freely competitive environment is to exist. In summary, it has been shown that those who write the standards are those trade associations and engineering societies which specialize in that particular area under consideration. The benefits of standardization come virtually free to the consumer, as with any public good, but those firms who choose to employ voluntary standards do so only if they can afford to and if it is in their best interest to do so.

As there are many motives for standards, so can the effects of standards vary widely. Some standards, for instance, can decrease search costs, minimize brand distinctions, and lower entry barriers. Design standards, on the other hand, sometimes raise barriers and impede innovation. Where buyers promote standards, it can be anticipated that the market effects will prove beneficial. Where

sellers promote standards, the market effects are more uncertain [Ref 1:p. 79]. It has been postulated that standards are generally created when desired by major firms, and rarely if opposed by them (unless other large concerns force standardization); and that when quality standards are created, it can be predicted they will be written at levels that help established, dominant firms maintain their dominance [Ref. 1:p. 90]. This postulation has not been proven, except perhaps on a case basis. In general, voluntary standards are written when the industry feels that creation would enhance the economic well-being of the industry and also that of the buyer. This is not to suggest that business is, or should be, a consumer advocate. It does suggest, however, that, in general, what's good for the business will most likely be good for the buyer. After all, who, but the buyer, has a significant impact on what gets purchased from those very same firms? It must be emphasized, however, that standards adoption is encouraged by the large buyers (firms). It is they who will call out standards in their purchase orders, if standards are to be used. Also, small sellers have an incentive to comply with a standard set by a larger firm if they want to capture some of that market share.

The role of the private standards setting organizations, in the private sector, has been discussed. It has been shown that voluntary standards are written, for the most part, by trade and technical associations. Some of the standards that are written are those that the larger corporations underwrite because of the need for research and development (funds and/or facilities) or because the industry arrived at a consensus regarding the need for a particular new standard. ANSI's

consensus principle is crucial to the development of American standards, for without it a definite imbalance, in favor of the larger companies, would be possible.

But what about the Federal government? How do they fit into the scheme of things? This and other questions will be addressed in the next section with particular emphasis on the Department of Defense (DoD) policies and procedures for the development and adoption of standards and specifications.

III. THE FEDERAL GOVERNMENT: POLICIES, PROCEDURES, AND PROGRAMS

A. BACKGROUND

Each year a sizable portion of the defense budget is used to buy new weapons systems and other defense-related items. DoD's fiscal year 1985 budget, for example, includes \$97 billion in the procurement account. The procurement account has grown substantially in recent years. Between fiscal years 1980 and 1985, it increased by 177 per cent, compared with an overall DoD budget increase of 99 per cent. For example, in fiscal year 1980, the procurement account represented 24 percent of DoD's budget; in fiscal year 1985, it represented 34 per cent. Additional billions of procurement-related dollars are included in the military construction and in the research, development, test, and evaluation budget accounts. The Congress has expressed increasing concern over the way DoD buys goods and services. For example, these concerns were recently brought to the attention of the general public when reports of \$600 dollar hammers and over-priced toilet seats made the local news. Given this atmosphere of increasing procurement budgets, Congressional concern, and public awareness, the Federal government, and in particular the DoD, are concerned with developing workable policies which will help ensure the selection and development of the the most cost effective weapons, support equipment, and supplies.

B. INITIATIVES

The problems with the defense acquisition process have been going on for many years and as a result there have been various initiatives implemented which recognize the problems and suggest methods of solution. One such initiative, and the subject of this paper, is in the area of materiel standardization.

The need for standardization has been the subject of, or has been included, in many DoD studies, papers, policy decisions, directives, and regulations. For example, the Acquisition Strategy Guide, published in July of 1984, states, "The overall trend in military standardization today is to emphasize interface standards, rather than component standards, because the fast-moving technology base often renders specific components obsolete before the system is fielded." The 1985 edition of the Navy Program Manager's Guide states, "The Program Manager (PM) should make use of existing Navy standard hardware and software. Use of standard materials and procedures lead to life cycle cost benefits, higher reliability, and established logistic support base, simplified training, and proper documentation." OMB Circular A-119 [Ref. 2], states that is the policy of the Federal government to: (1) rely on voluntary standards, whenever feasible, (2) participate in voluntary standards bodies when in the public interest, and (3) coordinate agency participation in voluntary standards bodies. The streamlining initiative, which will be discussed in Chapter IV, is an acquisition strategy which attempts to define the most cost-effective contract requirements for development of new weapons systems.

In order to more fully understand the background of Federal involvement, pertinent to nongovernment standards, and the extent of DoD participation in the process, the following sections will focus on two of the more significant initiatives mentioned above. A discussion of OMB Circular A-119, will be followed by a review of the Defense Standardization and Specification Program (DSSP). Included in the review of the DSSP will be a discussion of the methods by which the DoD interacts with nongovernment standards setting bodies.

C. OMB CIRCULAR A-119

1. Background

On January 17, 1980, during the Carter Administration, the Office of Management and Budget (OMB) issued Circular A-119 entitled "Federal Participation in the Development and Use of Voluntary Standards." This Circular established government policy concerning the use of voluntary standards by government agencies and the participation by government representatives in the voluntary standards activity. Under the provisions of the Circular the Department of Commerce was given authority to issue regulations implementing the Circular and to list those standards development groups which met the due process criteria set forth in the Circular. These regulations were proposed by the Department of Commerce. At the time the Reagan Administration took office these regulations were still under consideration. After careful study the Reagan Administration revised the Circular and eliminated the

regulatory provisions. The new Circular, issued October 26, 1982, met with ANSI's approval and the threat of regulation was removed [Ref. 3:p. 2].

2. Policy Statements and Guidelines

OMB Circular A-119, "Federal Participation in the Development and Use of Voluntary Standards" issued October 26, 1982, establishes policy to be followed by executive agencies in working with voluntary standards bodies. It also establishes policy to be followed by executive branch agencies in adopting and using voluntary standards.

a. Policy Statements

It is the policy of the Federal Government in its procurement and regulatory activities to:

- (1) Rely on voluntary standards, both domestic and international, whenever feasible and consistent with law and regulation pursuant to law;
- (2) Participate in voluntary standards bodies when such participation is in the public interest and is compatible with agencies' missions, authorities, priorities, and budget resources; and,
- (3) Coordinate agency participation in voluntary standards bodies so that (a) the most effective use is made of agency resources and representatives; and (b) the views expressed by such representatives are in the public interest and, as a minimum, do not conflict with the interests and established views of the agencies. [Ref. 4:p. 3]

b. Policy Guidelines

(1) Reliance on Voluntary Standards

- (a) Voluntary standards that will serve agencies' purposes and are consistent with applicable laws and regulations should be adopted and used.
- (b) Voluntary standards should be given preference over non-mandatory Government standards unless use of such voluntary standards would adversely affect performance or cost, reduce competition, or have other significant disadvantages.
- (c) In adopting and using voluntary standards, preference should be given to those based on performance criteria when such criteria may reasonably be used in lieu of design, material, or construction criteria.
- (d) Voluntary standards adopted by Federal agencies should be referenced, along with their dates of issuance and sources of availability, in appropriate publications, regulatory orders, and related in-house documents. Such adoption should take into account the requirements of copyright and other similar restrictions.
- (e) Agencies should not be inhibited, if within their statutory authorities, from developing and using Government standards in the event that voluntary standards bodies cannot or do not develop a needed, acceptable standard in a timely fashion. Nor should the policy contained in this Circular be construed to commit any agency to the use of a voluntary standard which, after due consideration, is, in its opinion, inadequate, does not meet statutory criteria, or is otherwise inappropriate.

(2) Participation in Voluntary Standards Bodies

- (a) Participation by knowledgeable agency employees in the standards activities of voluntary standards bodies and

standards-developing groups should be actively encouraged and promoted by agency officials.

- (b) Agency employees who, at Government expense, participate in standards activities of voluntary standards bodies and standards-developing groups should do so as specifically authorized agency representatives.
- (c) Participation by agency representatives should be aimed at contributing to the development of voluntary standards that will eliminate the necessity for development or maintenance of separate Government standards.
- (d) Agency representatives serving as members of standards-developing groups should participate actively and on a basis of equality with private sector representatives.
- (e) The providing of Agency support to a voluntary standards activity should be limited to that which is clearly in furtherance of an agency's mission and responsibility.

As can readily be seen from the above summary of OMB Circular A-119 the Federal government is indeed committed to the use of voluntary standards whenever feasible and consistent with law and regulation. In fact, the DoD has pursued this course for many years and is now doing so with increased vigor. It is DoD policy to participate in their development, and to adopt and use nongovernment standards to the extent feasible, practical, and economical. The adoption and use of acceptable nongovernment standards helps to ensure DoD use of products and practices which are readily available in the commercial marketplace, while minimizing the need to prepare and maintain military documents. While hard figures, regarding the number of nongovernment standards the DoD has adopted, are not available, it is

interesting to note that even though definitive product standards are the most difficult to prepare the DoD has prepared more than all other U.S. standards developers combined. Private sector standards have concentrated on basic standards such as materials, test methods, and interface features rather than definitive product standards that could be used for competitive procurement [Ref. 7:p 2-2]. The DoD standards creation and review process, and the Defense Standardization and Specification Program (DSSP) will be discussed in the following section.

D. DOD STANDARDS CREATION AND REVIEW PROCESS

1. The Environment

Down in the program offices of the military departments—where the real acquisition pick-and-shovel work gets done—many different communities are working energetically to develop and produce their respective weapon systems. These various communities contain personnel who may be described as program managers, engineers, contracting officers, logisticians, development planners, and those who represent the standardization community.

For the most part, the standardization community can be broken down into two basic parts: those who administer, develop, and maintain the military specifications, standards, policies, and associated documents; and those who enforce or control the application of standards and specifications, and make materiel standardization happen.

The first group of "standardizers" within the services obtain their tasking through their respective departmental standardization offices (DepSOs). The second group of "standardizers"- far fewer in number-receive their tasking from high-level military commanders, and their scope is generally limited to a specific commodity area.

All of the above communities should be working together, complementing one another as a united team with one shared objective-timely delivery of a cost-effective fighting machine in which all have significant pride. However, sometimes conflicting goals separate one or more of these communities as dramatically as those that divided the Hatfields and McCoys.

The department of Defense acquisition management hierarchy extends from the third floor of the Pentagon (where centralized control of executive policy direction occurs) to the program offices in the field (where decentralized policy implementation occurs). The same issues that often divide the specialized communities in the field also divide the Pentagon's third floor. When individuals within a community perceive that their important concerns are being pushed under the rug, they tend to escalate these issues within the hierarchy of their same community. As resistance to negotiation increases between these different communities, escalation, as well as escalation tactics, increases. As the debate continues, the communities become more and more polarized, bogging down the whole decision-making and program approval process. [Ref. 4:p. 50-51]

Understanding the environment within which the "standardizers" must function is important because a standards writer must have

sufficient information available in order to write an effective standard. Important questions, whose answers are essential to a valid evaluation of a DoD standard, is: Can a standards writer acquire sufficient information regarding the application and use of standards to foresee its collective costs and benefits?; and, if not: Is it possible that the standard, when written and applied, could lead to over or underspecification of the project? The creation of standards and specifications is, as expected, a complicated maze of policies, procedures, responsibilities, and instructions. Although the answers to the above posed questions are important, a detailed discussion of the step-by-step procedures used to create standards in the DoD would serve no useful purpose in this study. The interested reader is referred to DoD 4120.3-M, Defense Standardization and Specification Program Policies, Procedures, and Instructions, for a very detailed discussion of the subject. More useful to our purposes, here, is a discussion of the Defense Standards and Specification Program (DSSP), which will underscore DoD's commitment to standardizing whether it be through their own resources or through those of nongovernment standards setting bodies.

2. The Defense Standardization and Specification Program

a. General

The DoD currently has many specifications for items which are not inherently military. They include surgical instruments, office

furniture, subsistence products, etc. In the past, DoD documents were developed where suitable documents did not exist elsewhere. DoD is looking to the private sector to prepare documents covering non-military products and related engineering standards (test methods, quality assurance, etc.). Where they exist, or can be prepared, they will be used, thus freeing DoD's resources for concentration on military items. DoD use of a nongovernment standard may consist of direct copying, with permission, in a government document, referencing the nongovernment standard in a government document, or direct use of the document in acquisition. The specific approach will depend on the need, the type of nongovernment standard involved, and agreements with the Nongovernment Standards Bodies (NGSB).

Adoption of nongovernment standards started in 1962 when 12 documents were brought into the system. Since then the number has grown dramatically. DoD is not the only beneficiary in this program. NGSBs also benefit from DoD adoption and use of their documents. The DoD employs scientists and engineers, many of whom are leaders in their fields, and may offer valuable contributions through DoD participation in document development. In addition, adoption broadens the use of a nongovernment standard directly through defense contracts and indirectly through the added visibility provided by its inclusion in the Department of Defense Index of Specifications and Standards (DoDISS). [Ref. 5:p. 1]

b. The Program

The Defense Standardization and Specification Program (DSSP) was established in 1952 to improve the operational readiness and cost-effectiveness of defense material by promoting the development and use of common systems, subsystems, equipment, components, parts, materials, engineering practices, and technical data. It is a single, integrated, defense-wide program managed by the Under Secretary of Defense for Research and Engineering (USDR&E). The statutory requirement for such a program is contained in Title 10, U.S. Code, Chapter 145, Cataloging and Standardization as outlined below:

Defense Cataloging and Standardization Act

- Name, describe, classify, and number each item...in such a manner that only one distinctive combination of letters or numerals or both will identify the same item...
- Achieve highest practical degree of standardization.
- Develop and use single specifications.
- Eliminate overlapping and duplicative specifications.
- Reduce number of sizes, kinds, or types of generally similar items.
- Standardize packaging.
- Inspect and test efficiently [Ref. 6:p. 9].

The basic policy regarding DoD standardization is contained in DoD Directive 4120.3, Defense Standardization and Specifications

Program. The primary objective of this program is to ensure that optimal material standardization is achieved during the design, development, and acquisition process. This is accomplished by applying standardization principles, such as, item commonality, interchangeability, and interface compatibility, in engineering and acquisition management. [Ref. 6:p. 9]

The program encompasses the broad range of equipments, parts, materials, processes, and practices described in specifications, standards, engineering drawings, data item descriptions (DIDs), purchase descriptions, and Commercial Item Descriptions (CIDs) which are prepared and used by DoD activities. The DoD Index of Specifications and Standards (DoDISS) currently lists more than 45,000 active standardization documents prepared by DoD activities, other Federal agencies, and industry groups. To support DSSP objectives, more than 7,000 standardization projects are either underway or planned. The primary objective for all this is to achieve a state of material standardization within the Department of Defense and, in so doing reduce duplicative development and testing costs and control the proliferation of items in the inventory. [Ref. 6:p. 10]

Since its implementation, how well has the DSSP met its objectives? In a recent study, [Ref. 7:p. iii], the DSSP was found to be good at accomplishing its traditional tasks, but that significant improvements should be introduced to enable it to operate more efficiently and effectively, and respond to the more complex needs of today. In summary, the following are the findings of that study:

1. Many of the Program's shortcomings result from the decentralization that is inherent to the DoD structure and to parochial attitudes of the Services and Commands. While the Program must operate within these constraints, problems that are within the purview of the Program can be alleviated.
2. The study determined that the DSSP comprises two, essentially different, programs -- projects and functions in the traditional fields of standardization, and those complex fields that require special attention and special techniques. Alternative organizations and management approaches are suggested to accomodate the dichotomy.
3. The study found organizational and cultural factors that foster a reactive approach to standards. A prime reason is that standardization is perceived almost solely in terms of document preparation. Many personnel directly associated with the Program consider themselves standards writers, not standardizers. The standards user community is not involved sufficiently in determining objectives and priorities, and the scope of standardization projects. There is seldom real evidence that the majority of new standardization projects are regarded by the standards users as projects that rate priority attention and support. The inability of the standardization activities to associate their projects with a supporting constituency is reflected in funding authorizations by the Services and Commands.
4. Standards development within the DSSP is largely a voluntary process. The Services need not commit funds to support any obligation they may have to the Program. Assignee Activities have no authority over those in other Services, or agencies within their own Service, to whom work is assigned.
5. While standardization activities have been provided with broad guidance so they could focus their efforts, there is little evidence that this guidance has had any real influence at the Commands. In addition to objectives that can be converted into specific targets and assignments, the Program need priorities. It is essential to identify those tasks that should not be done. Methods for establishing objectives and priorities and assessing performance

are proposed. DoD is urged to concentrate its resources on those standardization actions that are vital to military equipment and readiness by reducing the number of standards for which DoD is custodian, but which are not mission related.

6. Opportunities to extend the knowledge and skills of standardization specialists are very limited. A comprehensive educational program is outlined, as well as training for DoD operational managers. It is also suggested that a standardization career field be established. [Ref. 7: p. iii-iv]

It seems readily apparent that although the Defense Standardization and Specification Program has lofty goals, and is doing many things right, the means to achieve the goals have not been specified in concrete terms. The Program is a good one; one that could achieve a great deal if only given unambiguous direction and support from higher authority. It's not enough just to have a Program, the Program must be backed with sufficient funding and a monitoring system that provides accurate feedback to those in positions responsible for its effective and efficient operation.

3. DoD Adoption of Nongovernment Standards

a. General

The DoD participates in the standards development activities of the Nongovernment Standards Bodies (NGSBs) and adopts nongovernment standards. These functions are closely integrated but remain separate and distinct. The DoD participates in the standardization activities of the NGSBs in accordance with the policy

principles of OMB Circular A-119. Where they meet DoD needs, standards prepared by the NGSBs will be adopted and used by the DoD [Ref. 5:p. 2].

Assignee Activities (AAs), responsible for standardization of a Federal Supply Class (FSC) of items, is also responsible for maintaining a continuous awareness of projects intended to result in nongovernment standards within the area of their assignments. Some activities manage many Federal Supply Categories and because many different NGSBs, each with its own set of working committees, prepare standards, the task of maintaining awareness is often difficult. When NGSBs help keep AAs apprised of projects, they will be better able to carry out their assignments [Ref. 5:p. 2]. The extent to which the AAs are carrying out their responsibilities can be summarized by the following two observations: (1) Management emphasis has been focused on immediate problems rather than the attainment of long-range goals. It is biased toward reaction rather than anticipation, and disposed to issue directives and instructions, rather than motivate and persuade, and; (2) Standardization activities (which include the AAs) within the Services have insufficient authority to marshal skills and resources and focus them on standardization tasks [Ref. 7:p. 2-4]. It appears from those two observations that if the NGSBs are interested in having a standard adopted by the DoD, or any other agency for that matter, the onus is on them, because apparently the AAs are not able, due to lack of resources, to initiate the liaison.

Therefore, NGSBs that prepare standards, and seek DoD adoption, are encouraged to seek DoD input either through a DoD representative to the group or through correspondence. The system of AAs and Lead Service Activities provides a clear set of contact points stratified by FSC [Ref. 5:p. 3].

b. Adoption

Adoption is the process by which DoD expresses formal acceptance of a specific issue of a nongovernment standard. Adoption of a specific issue of a nongovernment standard assures the DoD of internal control of the document in much the same manner as federal and military documents are controlled. The adopted issue is the one listed in the DoDISS and is the only version authorized for use by the DoD. Nongovernment standards which require modifications, additions, or deletions, to make them suitable for DoD use, are adopted on a limited basis through issuance of a government document which details the required changes. The adoption of a document offers the following advantages:

1. Adoption provides visibility for the document through its appearance in the DoDISS.
2. An adopted document is given a higher order of precedence for selection and use in DoD acquisition programs.
3. Adoption makes the document available to DoD components.
4. The proliferation of duplicative documents is reduced [Ref. 5:p. 3]

c. Adoption Criteria

Certain criteria, concerning applicability to DoD needs and document availability, are examined prior to initiating a project to adopt a nongovernment standard. With regard to applicability, documents which fully satisfy the needs of the DoD, with respect to technical sufficiency and economy, are generally adopted when one or more of the following conditions exist:

- (a) No satisfactory military document is available and a satisfactory nongovernment standard is available, or a NGSB is willing to provide a document in time to meet DoD needs.
- (b) Adoption of the nongovernment standard will provide the DoD with a document more technologically current than one already in the DoD system; and the cost of the product or service, covered by the nongovernment standard, will be less than the product or service procured to the military document it is intended to replace.
- (c) The nongovernment standard has potential for widespread use in the DoD which can be satisfied through adopting and listing in the DoDISS.
- (d) Internal control over the changes to the nongovernment standard is essential to preserve its utility to the DoD.
- (e) Adoption of the nongovernment standard would deter the proliferation of other similar duplicative documents within the DoD system.
- (f) Adoption of the nongovernment standard would enhance the program for the Acquisition and Distribution of Commercial Products (ADCoP).

A document may meet all of the above criteria but if it is not readily available, or becomes unavailable after adoption, it is of little use to the DoD. Specific availability requirements are negotiated by the Naval Publications and Printing Service Office (NPPSO). It is necessary that sufficient copies of the document, either purchased or reproduced with permission, be available to satisfy DoD needs. [Ref. 5:pp. 3-4

d. DoD Adoption Procedure

A nongovernment standard may be introduced into the adoption process in several ways. DoD staff participation in the activities of the standards writing committee or working group is one way. Other possibilities are:

1. When a DoD activity identifies a need for a new or revised document, it will see if a satisfactory nongovernment standard already exists or if a project is currently underway to develop one.
2. If a standard does not exist and time permits, the activity will encourage a NGSB to prepare one.
3. A NGSB may recognize a DoD need and offer an existing document for adoption. In this case, the NGSB should present the proposal to the cognizant Assignee Activity (AA). That activity will work with the NGSB to determine the initial feasibility of the proposal. A Military Coordinating Activity (MCA) will be appointed by the AA to coordinate the document within the DoD.

In any of these cases, if the document in question will satisfy DoD needs and other adoption criteria, the MCA will coordinate the document. An adequate quantity of documents must be available for

coordination (at least 12 copies). Another alternative would be to allow limited royalty fee rights to reproduce for coordination only. Based on the results of the coordination, the MCA will do one of the following:

- a. If all interested activities accept the document as written, proceed to adopt it as a coordinated document.
- b. If some, or all, of the interested activities object to the use of the document, the MCA will review the objections, attempt to resolve issues with objectors and the NGSB, and make a determination to either terminate the adoption process or to adopt it for use by only those activities who concur in its use.
- c. If modifications, additions, or deletions are required, the MCA will:
 - (1) Attempt to get DoD requirements included in the nongovernment standard as a "when specified" paragraph or as an appendix.
 - (2) Make other arrangements for handling DoD requirements.
 - (3) As a last resort, prepare a Commercial Item Description (CID), federal or military specification or standard, stating the unique DoD requirements and making the nongovernment standard the primary reference.

Based on the results of the coordination, the MCA will prepare either an Acceptance Notice or the appropriate military or federal document. A copy of the Acceptance Notice will be provided to the NGSB. The MCA will request coordination on future revisions to the document and where a government document was issued, will attempt to have DoD requirements accommodated in future revisions. Copies of the document will be purchased or reproduced, with permission, to meet DoD needs, and indexed in the DoDISS. Adopted nongovernment standards are not distributed outside of the DoD. Other government activities,

contractors, and other users must obtain copies from the issuing NGSB, commercial document services, or libraries. [Ref. 5:pp. 4-5]

E. SUMMARY

As can be seen from the information just presented, the DoD is very interested in using the nongovernment voluntary standards system. As a matter of fact the DoD would much prefer to use nongovernment standards than to have to be forced to develop their own. The reasons for this are as previously discussed. Also discussed were the Defense Standardization and Specification Program and the various methods and procedures used by the DoD to adopt nongovernment standards.

The next section will present some examples where military standards, in some cases, presented some problems. In addition, there will be some discussion pertinent to trading-off standards and specifications relative to other considerations such as cost and schedule. In particular, discussion of the streamlining initiative will be highlighted.

IV. STANDARDS IN ACTION

A. GENERAL

In the previous chapters a review was conducted of the nongovernment standards setting bodies; an evaluation of standards, regarding the impetus for standards writing, who benefits, and the various types of standards; DoD interaction with nongovernment standards setting bodies, the environment within which they work, and their policies, procedures, and directives. The following sections will show the relationship between DoD acquisitions and the application of standards. It is the objective of this chapter to demonstrate, through the use of examples, that the Department of Defense, on occasion (some say often), applies standards in an inefficient and costly manner. It is also the intent of this chapter to discuss at least one initiative, that the DoD is involved with, which has a great potential to assist the DoD in streamlining the acquisition process, and in particular to decrease, and possibly eliminate, the inappropriate use, or misapplication of, standards and specifications.

B. DOES ANYONE KNOW WHERE WE'RE GOING?

The DoD specifications and standards are essential to technical procurement, and provide "lessons learned" to help ensure quality products. However, specifications can be called out that are inappropriate, premature, untailored, or accidentally referenced; these specifications drive cost and can prevent contractors from implementing optimum design solutions. The imposition of these unnecessary requirements can also result in extensive engineering change proposals (ECPs), which serve to remove inappropriate requirements. [Ref. 8:p. 15]

Assuming, then, that the above assessment is correct, it would seem that, generally speaking, the DoD has had some difficulty, in the past, with the proper application of standards and specifications to their various acquisitions, especially those technical in nature. To illustrate, the following sections will present examples where standards, or the lack of standardization, have somewhat complicated the acquisition of various types of equipment.

C. EXAMPLES

1. Performance Specification/Non-Standardization

A relatively basic performance specification is that used for valves in the Sewage Collection Holding and Tank System (CHT) aboard Navy ships. One of the basic problems associated with this kind of specification is the lack of control of a standardized inventory. This specification ultimately leads to a proliferation of non-interchangeable components. As the specification is written, either a plug or ball valve can satisfy the requirement. Hence, a typical frigate will have installed about forty such valves; some of which may be plug valves from manufacturer A, plug valves from manufacturer B, ball valves from manufacturer C, etc. The net result is havoc in the supply support community. [Ref. 9:p. 13]

2. Performance Specification/Complexity

Another example of an item using a performance specification is a fork lift truck. The choice of a fork lift truck is to point out the complexities that a basic performance specification can take on. The fork lift specification refers to: 45 other Federal/Military specifications and standards; 7 separate industry standards; 66

different combinations of tests and evaluations; and extensive physical performance tests.

Some of the advantages are: the flexibility of the design permitting considerations of various alternatives; competition based on design and quality assurance as well as price; and utilization of commercial market technology. However, the limitations are quite extensive. First, the contractor must be capable of deciphering the interwoven and cross-referenced specifications. Second, he must have testing facilities that include a 750 foot track complete with concrete chuck holes, a sandy beach, and a body of sea water to a depth of at least five feet. This last requirement places a restrictive burden on companies located inland unless they have access to elaborate testing facilities. Third, the maintenance of this specification is complex, since a change to this or any one of the other cross related specifications or standards may require modification to the whole specification. Finally, each subsequent procurement can lead to another contractor and design resulting in further non-standardization. [Ref. 9:p. 13-14]

3. MIL-M-38510

The specification used by the military to buy integrated circuits is called MIL-M-38510, also known as the Joint Army-Navy (JAN) system. This is really a set of specifications, made up of a general

specification and a series of detailed drawings called "slash sheets." The general MIL-M-38510 specification identifies all design, materials, finish, test, and qualification requirements for integrated circuits, regardless of type, sold to the government with a "JAN" marking on them. The Department of Defense established the JAN specifications as standards for all basic semiconductor types to secure the benefits of standardization of parts (particularly to make possible volume production of military semiconductors). For a time the JAN program did achieve its objective, but gradually the effectiveness of the system has eroded.

Any part sold with a JAN marking branded on it must meet all of the requirements of MIL-M-38510 which contains over 150 pages of requirements. In addition, JAN parts must meet all product specific requirements of the slash sheets which typically contain 30 to 40 pages of details about product performance [Ref. 11:p. 4]. "Everything, military and commercial, starts out with the same quality, because it all comes out of the same fabrication. But then the military specs require too many insertions. We perform multiple environmental screens, then burn parts in, reinspect them, re-burn them, retest each one, and there's really no improvement in the quality or the reliability of the part. Once you finish assembling a part, you can't do anything to make it more reliable." [Ref. 10:p. 16]

Yet, the government actually buys few IC's directly. There is almost no government financial responsibility for the costs associated

with the program. All costs are borne by the Original Equipment Manufacturers (OEMs) who ultimately buy JAN parts for the various programs. The OEM, or the vendor, cannot alter in any way, any of the requirements of the specification by purchase order or specific purchase contract. To procure something different the OEM must either use a Source Control Drawing (SCD) format or purchase a vendor standard part ("look alike"). [Ref. 11:p. 5]

Despite the attempt to reduce costs through standardization, JAN chips are often more expensive than non-JAN products. There is, therefore, an incentive for contractors to use other sources, i.e., use an SCD or purchase a "look alike", which are usually more similar to devices that the semiconductor companies sell commercially. [Ref. 11:p. 6]

It's possible, by reviewing the above examples, to come to the conclusion that Military specifications are, in general, too long, too restrictive, and too costly to apply. That's exactly the reason those particular examples were chosen, i.e., to prove the point that in a mass of over 40,000 documents there is bound to be some ludicrous requirements that make great anecdotes (such as a 15 page chewing gum specification) which often are used to disparage the system in general, rather than crediting its strengths. The DoD recognizes and understands that there are problems; problems which can and must be fixed. In a speech to the National Security Industrial Association on December 6, 1984, Mr. William H. Taft IV, Deputy Secretary of Defense, stated, "Calls

for reforming the way we apply military specifications and standards is not a new problem. In introducing reform, however, it is important to understand why these requirements developed in the first place. Most military specifications are worthwhile documents that reflect 'lessons learned,' and we most want to avoid repeating mistakes. Let's admit there are also less-valid factors that have led to the existence of some of those specifications; factors we need to change." [Ref. 13:p. 3]

D. THE STREAMLINING INITIATIVE

Former Deputy Secretary of Defense, Paul Thayer, signed January 11, 1984, a memorandum to secretaries of the military departments calling for improvement in Department of Defense contract requirements. The memorandum contains recommendations that "call for precluding untimely, untailored, and accidently-referenced application of specifications and standards and for specifying 'results' required rather than detailed 'how to' procedures in contracts and requests for proposals (RFPs)." [Ref. 14:p. 2] In the memorandum each service secretary was directed to choose four or more programs for special application of the streamlining initiative [Ref. 13:p. 4].

Acquisitioning Streamlining is "any action that results in more efficient and effective use of resources to develop, produce, and deploy quality defense systems and products. This includes ensuring that only cost-effective requirements are included, at the most appropriate time,

in system and equipment solicitations and contracts." [Ref. 15:p. 2-1]

In pursuing the initiative the following tenets are to be observed:

- (1) to utilize contractor ingenuity and experience;
- (2) to encourage early industry involvement, including use of draft requests for proposal (RFP);
- (3) to specify what is needed, not "how to";
- (4) to specify system level functional requirements early;
- (5) to require contractors to tailor for the next phase of the program;
- (6) to preclude premature application of military standards and specifications;
- (7) to limit contractual applicability to one level of references;
- (8) to pursue economically producible, operationally suitable, and field supportable designs; and
- (9) to assure complete production specifications while providing contractor flexibility to optimize design. [Ref. 14:p. 2]

But, doesn't the implementation of such a concept have risks associated with it, especially to the program manager and to the contractor? For instance, the program manager who urges modifying or deleting requirements is always open to the criticism; if something goes wrong, that stricter enforcement of requirements would have prevented trouble. The contractor, likewise, doesn't want to risk losing a bid by suggesting that initial requirements could hurt performance, or

raise costs. The Honorable William H. Taft, stated that for those reasons, and others, "it is vital that reducing overspecification be a top-level management priority in DoD and industry. Our people need to know they will be rewarded for inventive ways to improve productivity and meet mission requirements at a lower cost; indeed, they need to know tailoring specifications and standards is a critical requirement of their jobs. We are not asking them to eliminate needed specifications and standards, but rather to identify only those that are essential, and to tailor these to fit the specific needs of the program." (Ref. 13:p. 4)

Since its implementation, how well has the Streamlining Initiative done? Since its implementation, over 36 Programs (Air Force, Army, and Navy) have been scrutinized with streamlining as a goal. While there are no firm figures on the total savings realized by streamlining these programs, the next few sections will discuss two of these programs regarding the methodology of streamlining and the results.

1. Streamlining the AMST

The Advanced Medium Short Take-Off and Landing Transport (AMST) program was suffering from overspecification, increasing costs, and a resultant lack of flexibility. The initial AMST program guidance in specification tailoring was provided by the Director of Research and Engineering, Office of the Secretary of Defense, as follows: "Request the Air Force investigate all feasible ways to decrease costs, such as:

eliminate hardware, specifications, test and special requirements which are not absolutely essential and which can be eliminated at acceptable risks. . . ." [Ref. 16:p. 31]

The specifications and standards tailoring effort in the AMST Program took more than a year to complete. The process started with extensive requirement iterations with the contractors to identify high-cost drivers in the specifications and standards, to quantify these cost drivers in comparison with trade-offs on research and development, production, and operations and support (O&S) costs. The cost effective trade-offs were then reviewed by using the command and support agencies to assure the end-product satisfied their requirements. This review process provided a set of well-scrutinized, performance-related requirements, which were used by the engineers to limit the number and scope of the specifications on contract. Once the requirements were defined, a zero-based budget specification approach was adopted; that is, all commonly used specifications were eliminated and only replaced when the appropriate system project office discipline adequately justified the need for the specification in terms of the approved performance requirements. After acceptable specifications were determined, experts were used to assure that radical surgery had not removed important requirements. [Ref. 16:p. 34]

The results of specification tailoring in the AMST Program are, for example: (1) in two instances, commercial practices regarding the method of installing fasteners and their requirements for shot-peening

forgings were both adopted and the MIL-SPEC requirement for different procedures was dropped; (2) the flight control specification was reduced from 66 to 51 pages by eliminating requirements that dictate design solutions, and by eliminating 82 sub-tier specifications; (3) for the landing gear, eight military specifications and two military standards (over 200 pages of requirements) were replaced with 13 pages in the subsystem requirements document; (4) for the cargo winch, 1-page military specification, with 28 applicable sub-tier specifications, were replaced with 75 words in the subsystem requirements document, and; (5) the inertial navigation system (INS) requirements, previously described in 12 military specifications, 19 military standards, 5 publications, and 125 pages of INS specifications, were reduced to a half-page requirement giving four key elements (position accuracy, velocity accuracy, attitude and heading, and alignment). [Ref. 16:p. 35]

2. The Navy T-45 Training System (T45TS)

The mission of the T-45 Training System is to provide and support a jet-flight training system for intermediate and flight training of Navy and Marine jet pilots. It is a derivative of the British land-based Hawk system redesigned to include aircraft carrier capability. Faced with the challenge to reduce program costs from \$727 million to \$450 million, or face cancellation, the T45TS Program

attacked every cost driver. The T45TS Program Office and the contractor team had just a few months to restructure the program; achieve cost savings and cost avoidance wherever possible; and maintain the technical and operational capabilities of the system. Intuitively, the program office and the contractors recognized that potential savings might be significant in the areas of specifications and standards, and contract data requirements. However, these elements were basic to system definition and were pervasive in every subsystem and component of the T45TS. There was reluctance to challenge the standards and specifications that had been invoked on generations of Navy systems. However, standards and specifications proved to be a particularly fruitful area for cost reduction.

Navy/contractor Tiger Teams were formed and were charged to streamline specifications and standards by determining minimum essential technical requirements without sacrificing material needs and particularly to isolate essential performance requirements from detailed design requirements. Because the T45A was derived from the proven British Aerospace Company (BAe) Hawk aircraft, the team concentrated on the Navy's T45A Aircraft Detail Specification. Nearly 80 percent of overall system cost was in the aircraft. As originally prepared, many requirements of the Aircraft Detail Specification required "Americanization" of British practices and processes. The Tiger Team applied the tailoring principals of DoD-HDBK-248 and developed the following strategies to accomplish their goal:

- a. Limit the contractor's obligation for specification compliance only to the second tier level of referenced documents for non-critical components and the third for critical, safety, or flight components.
- b. Examine existing specification applications to determine which could be candidates for (1) deletion, (2) additional tailoring, or (3) use by the contractor for guidance purposes only to meet the design intent that the particular specification imposed.

Closely associated with this specifications and standards streamlining initiative was reduction of contractor data submittals referenced in the Contract Data Requirements List (CDRL). In performing this task they took into account the impact that the streamlining process had on engineering documentation; the types, quantities, and format of data to be delivered by the contractor, along with a management philosophy that could be applied consistently to the entire system.

The payoffs of these efforts are as follows: (1) A typical aircraft development program includes references to an estimated 6000 specifications and standards; the T45A references 350, of which 281 are contractually invoked; (2) Approximately 20 percent of the documentation consists of British engineering standards and related documents, and; (3) Total overall data requirements were reduced from 530 to 251.

Because standards and specifications pervade the entire system and, because actual data costs were not identified, a specific figure

cannot be established that accurately represents cost avoidance from just this effort. However, engineering development was authorized in October 1984 when the contractor entered into a firm fixed price contract for \$438 million. An assessment of overall risk from program restructuring, including specification tailoring, resulted in a slight increase in the risk regarding the schedule and the contractor (from low to moderate), and a slight decrease in the risks associated with concurrency and the government (from moderate to low). The risk associated with the technical nature of the program remained low. [Ref. 17:pp. IV-1 to IV-5]

Some of the problems encountered with these two efforts include: communication, i.e., convincing people that the approach is right; resistance, i.e., resistance in the support bureaucracy [Ref 16:p. 33], for example, convincing functional personnel to develop innovative, new, and less restrictive approaches for achieving technical requirements (getting rid of the "this is always what we require in a development program" attitude)[Ref. 17:p. IV-5]. Other problems included: crossing over the invisible barrier that typically exists between government and contractor i.e., developing mutual trust and respect; overcoming the language barrier that existed between government and contractor i.e., the government talked about contract line items while the contractor utilized the Work Breakdown Structure, and; acceptance by contracting and pricing personnel of the technical

negotiations concept i.e., both sides had to share cost estimates to get agreement on cost for each major element [Ref. 17:pp. IV-5 & IV-6].

3. CONCLUSIONS

The above are just two examples where the concept of streamlining has been successful. As can be seen it is not an easy effort. It takes a great deal of time, energy, dedication, compromise, and a willingness to depart from old ways of doing things. But, it does work. It has been proven by these examples and many others. According to the Honorable William H. Taft IV, "Our efforts are paying off. Programs are stable with efficient production rates. Major program cost growth has been reduced from about 14 percent annual real growth in 1981, to less than one percent in each of the last two years. While I cannot quantify how much more capable our forces are today, than they would be without the management improvements and acquisition reform efforts of the last 5 years, I do know that those efforts, including acquisition streamlining, have made a difference." [Ref. 18:p. 18]

V. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

A. SUMMARY

In summary, the purpose of this research was to investigate the role of the nongovernment standards setting bodies and the Department of Defense in the standards setting process. Additionally, an investigation was made into current DoD initiatives to streamline the acquisition process via more efficient selection and application of standards and specifications. In particular, discussions and analyses were conducted in the areas of private standards setting organizations, the motives for developing and using standards, the various types of standards, and some problems encountered regarding the use or non-use of standards. Additionally, attention was focused on Department of Defense (DoD) policies and procedures for the development and adoption of standards and specifications and methods of interacting with nongovernment standards setting organizations. Finally, specific examples were discussed regarding specification and standardization problems in the DoD followed by review and analysis of the DoD's Streamlining Initiative.

B. CONCLUSIONS

The following conclusions were developed as a result of this research effort:

1. The development of standards and specifications, in the private sector, is highly decentralized. However, the majority of private (voluntary) standards are developed and adopted for the most part by three organizations: the American National Standards Institute (ANSI), the American Society for Testing and Materials (ASTM), and the Aerospace Industries Association (AIA). Although these organizations wield a good deal of power they are kept in check by their own system of checks and balances, e.g., the "consensus principle" and to some extent by government pressure and regulation.
2. The Department of Defense (DoD) prescribed policies and procedures specifically dealing with DoD interaction with nongovernment standards setting bodies (NGSBs) and the ways in which the NGSB's may interact with the DoD are fairly well-written, understandable, and in general, easy to follow. However, problems arose while attempting to decipher the methods used by the DoD to develop, write, and adopt their own standards. The questions posed earlier, i.e., "Can a standards writer acquire sufficient information regarding the application and use of a standard to foresee its collective costs and benefits?" and, "If not, what are the possibilities of over or underspecification?" are serious concerns that must be addressed.
3. DoD specifications and standards are, in some cases, applied in a haphazard manner, without regard to the particular needs of the project. The Federal government and, in particular, the DoD is concerned over the inappropriate use, or misapplication of, standards and specifications. Specifically, the DoD, is concerned with excessive costs and lack of flexibility in the design of military equipment. The DoD has come to realize that among

other cost drivers, standards and specifications play a major role in almost any acquisition. They have come to understand that, although standards and specifications are a good format for "lessons learned", there are problems with some of them as written and should not be applied in a haphazard manner.

4. That the DoDs Streamlining Initiative has been successful in its objective to avoid costly and unnecessary requirements. Although the initiative is extremely time-consuming to apply, the payoffs, as described by the examples in Chapter IV, are significant. Standards and specifications have been found to be a particularly fruitful area in which to simplify design, without compromising performance, and make significant savings in the overall cost of the system.

C. RECOMMENDATIONS

Recommendations, as a result of this study, are as follows:

1. In an attempt to simplify the literature, regarding the "down in the trenches" work of standards writing in the DoD, recommend an evaluation of that process be conducted and the results published in an easy to read, and follow, manual.
2. When in the process of writing DoD standards and specifications, standards writers must have access to complete and objective information. Additionally, rather than writing standards such that they meet every possible contingency, recommend standards be written such that a menu of specifications is available. Specifications can then be selected depending on the application. Furthermore, recommend that, when in the process of writing standards and specifications, liaison with the NGSBs be established and maintained in order to ensure that the standards, as approved, reflect the most current technology and current processes employed by the private sector.

3. That all military standards and specifications, when used in all future DoD acquisitions, be subject to close scrutiny and streamlining before the project becomes an object of concern. In the initial design phase, and throughout the development, the project must be scrutinized, on an iterative basis, to assure that standards and specifications are not over-applied, mis-applied, or applied as a result of error.

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